AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application.

1. (Previously presented) A fluorometer for detecting the level of fluorescent material in a body of water, the fluorometer comprising:

an excitation system including an excitation source for producing excitation light capable of causing fluorescence in fluorescent material; and

a detection system for detecting said fluorescence, wherein

said excitation system comprises an excitation source comprising one or more light emitting diodes (LEDs), the excitation system further comprising means to cause said excitation light to form, in use, a generally conical divergent beam projecting from the fluorometer, said beam causing means comprising at least one collimating lens, said excitation system further including means for modulating said beam with a modulating signal having a modulating frequency, and wherein

said detection system comprises means for receiving light and for converting said received light into a corresponding electrical signal, and at least one lens arranged to direct said received light onto said light receiving and converting means, wherein said at least one lens of the detection system is arranged to provide a generally conical convergent detection volume for the detection system, said generally conical detection volume converging in a direction towards said fluorometer and at least partially overlapping with said generally conical divergent beam and wherein

said detection system further includes means for detecting, in the electrical signal produced by said light receiving and converting means, a signal component of substantially the same frequency as said modulation frequency, said detecting means including means for performing spectral analysis of said electrical signal and means for determining the value of a spectral component of said electrical signal corresponding to said modulation frequency,

wherein said detection system is arranged to determine the level of fluorescent material present in said body of water depending on said value of said spectral component, such that the fluorometer is capable of detecting fluorescent material located remotely from the fluorometer in said body of water.

2. (Canceled)

3. (Canceled)

4. (Previously presented) A fluorometer as claimed in Claim 1, wherein said excitation source is located substantially at the focal point of the nearest to the excitation source of said at least one lens.

5. (Previously presented) A fluorometer as claimed in Claim 1, wherein said excitation system includes a collimator for forming said generally conical divergent beam.

6. (Previously presented) A fluorometer as claimed in Claim 1, wherein said excitation source comprises a plurality of LEDs arranged in a generally rectangular and at least one dimensional array.

7. (Canceled)

8. (Previously presented) A fluorometer as claimed in Claim 1, wherein said modulating means is arranged to amplitude modulate said beam.

9. (Previously presented) A fluorometer as claimed in Claim 8, wherein said modulating means is arranged to modulate said beam by adjusting the power supply of the excitation source in accordance with said modulating signal.

10. (Canceled)

11. (Canceled)

12. (Previously presented) A fluorometer as claimed in Claim 1, wherein said light receiving and converting means comprises a photodetector.

13-15. (Canceled)

16. (Previously presented) A fluorometer as claimed in Claim 1, wherein said light receiving and converting means is located substantially at the focal point of the nearest to said light receiving and converting means of said at least one lens.

17. (Canceled)

18. (Previously presented) A fluorometer as claimed in Claim 1, wherein said detecting means is arranged to detect, in the electrical signal produced by said light receiving and converting means, a signal component of substantially the same frequency as said modulation frequency and substantially in phase with the modulation of said beam.

19. (Canceled)

20. (Previously presented) A fluorometer as claimed in Claim 1, wherein the excitation system and the detection system are each provided in a respective housing, the respective housings being located adjacent one another and arranged such that there is an overlap, during use, between said generally conical divergent beam emanating from the excitation system housing and said generally conical convergent detection volume of the detection system housing.

21. (Previously presented) A fluorometer as claimed in Claim 20, wherein the respective housings are adjustably interconnected so that the relative angular disposition between the

respective housings may be altered such that the distance of said overlap from said respective housings is altered.

22. (Original) A fluorometer as claimed in Claim 21, wherein the respective housings lie generally in a common plane, the relative angular disposition of the housings being alterable about an axis that is substantially perpendicular to said plane.

23. (Previously presented) A fluorometer as claimed in Claim 1, wherein the excitation system and the detection system are located in a common housing.

24. (Original) A fluorometer as claimed in Claim 23, wherein said common housing comprises a window and at least one inner chamber, at least part of the excitation system and at least part of the detection system being located in said at least one inner chamber, said at least part of the excitation system being arranged so that said beam is projected, during use, out of the housing through said window, said at least part of the detection system facing away from said window, and wherein a reflecting surface is located inside the housing facing said window and beyond the detection system with respect to said window, said reflecting surface being arranged to direct light entering, during use, said housing through said window onto said detection system.

25. (Previously presented) A fluorometer as claimed in Claim 24, wherein said at least part of the excitation system and said at least part of the detection system are located substantially co-axially with one another within said housing.

26. (Previously presented) A fluorometer as claimed in Claim 24, in which said at least one inner chamber is located substantially on the longitudinal axis of said housing.

27. (Original) A fluorometer as claimed in Claim 23, wherein said common housing comprises a window and at least two inner chambers, at least part of the excitation system being located in a

first inner chamber and at least part of the detection system being located in a second inner chamber, said at least part of the excitation system being arranged so that said beam is projected, during use, out of the housing through said window, said second inner chamber being located beyond said first inner chamber with respect to said window, said at least part of the detection system facing towards said window, and wherein a reflecting system is located between the first and second inner chambers and is arranged to direct light entering, during use, said housing through said window onto said detection system.

28. (Original) A fluorometer as claimed in Claim 27, wherein said reflecting system comprises a first reflecting surface facing towards said window and a second reflecting surface facing away from said window, the first reflecting surface being arranged to direct light entering, during use, said housing through said window onto said second reflecting surface, said second reflecting surface being arranged to direct said light onto said detection system.

29. (Original) A fluorometer as claimed in Claim 28, wherein said first reflecting surface is shaped to define an aperture, said detection system being positioned to receive light from said second reflecting surface through said aperture.

30. (Previously presented) A fluorometer as claimed in Claim 27, wherein said reflecting system comprises a Cassegrainian mirror system.

31. (Previously presented) A fluorometer as claimed in Claim 1, further including a laser device carried by the fluorometer and positioned to project, during use, a laser beam in a direction generally parallel, or aligned, with the excitation beam.

32. (Currently amended) A fluorometer as claimed in Claim 1, wherein the fluorometer comprises at least one housing, the or each housing comprising a window through which said excitation beam is projected during use and/or ~~though~~ through which light is received during use,

wherein said excitation source is slidably moveable towards and away from the window of the housing in which it is located.

33. (Currently amended) A fluorometer as claimed in Claim 1, wherein the fluorometer comprises at least one housing, the or each housing comprising a window through which said excitation beam is projected during use and/or ~~though~~ through which light is received during use, wherein at least one lens of said lens system is slidably moveable towards and away from the window of the housing in which it is located.

34. (Currently amended) A fluorometer as claimed in Claim 24, wherein the fluorometer comprises at least one housing, the or each housing comprising a window through which said excitation beam is projected during use and/or ~~though~~ through which light is received during use, wherein at least one reflecting surface is slidably moveable towards and away from the window of the housing in which it is located.

35. (Previously presented) A fluorometer as claimed in Claim 18, further including means for determining the amplitude of said signal component, and means for generating an alarm when said amplitude exceeds a threshold.

36. (Canceled)

37. (Previously presented) A vehicle as claimed in Claim 44, wherein the vehicle includes at least one first moveable structure for carrying, during use, a camera or lamp, the fluorometer being carried by a second moveable structure, wherein said at least one first moveable structure and said second moveable structure are coupled electrically and/or mechanically so that the movement of the second structure is synchronised with the movement of said at least one first structure.

38. (Canceled)

39. (Previously presented) A fluorometer as claimed in claim 1, wherein said excitation system is arranged such that said beam is capable of causing fluorescence in fluorescent material at distances of up to several meters from the fluorometer.

40. (Previously presented) A fluorometer as claimed in claim 39, wherein said excitation system is arranged such that said beam is capable of causing fluorescence in fluorescent material at distances of between 1 and 15 meters from the fluorometer.

41. (Previously presented) A fluorometer as claimed in claim 20, wherein the respective housings have a respective longitudinal axis, said longitudinal axes being substantially parallel with one another, and said generally conical divergent beam and said generally conical convergent detection volume are substantially aligned with said respective longitudinal axis.

42. (Previously presented) A fluorometer for detecting the level of fluorescent material in a body of water, the fluorometer comprising:

an excitation system including an excitation source for producing excitation light capable of causing fluorescence in fluorescent material; and

a detection system for detecting said fluorescence, wherein

said excitation system comprises an excitation source comprising one or more light emitting diodes (LEDs), the excitation system further comprising means for causing said excitation light to form, in use, a generally conical divergent beam projecting from the fluorometer, said beam causing means comprising at least one collimating lens arranged to cause said excitation light to form a substantially collimated elongate beam that projects, during use, from the fluorometer, and said excitation system further including means for modulating said collimated elongate beam with a modulating signal having a modulating frequency, said excitation system being arranged such that said beam is capable of causing fluorescence in fluorescent material at distances of up to several meters from the

fluorometer, and wherein

said detection system comprises means for receiving light and for converting said received light into a corresponding electrical signal, and at least one lens arranged to direct said received light onto said light receiving and converting means, wherein said at least one lens of the detection system is arranged to provide a generally conical convergent detection volume for the detection system, said generally conical detection volume converging in a direction towards said fluorometer and at least partially overlapping with said generally conical divergent beam, and wherein

said detection system further includes means for detecting, in the electrical signal produced by said light receiving and converting means, a signal component of substantially the same frequency as said modulation frequency, said detecting means including means for performing spectral analysis of said electrical signal and means for determining the value of a spectral component of said electrical signal corresponding to said modulation frequency, wherein said detection system is arranged to determine the level of fluorescent material present in said body of water depending on said value of said spectral component such that the fluorometer is capable of detecting fluorescent material located remotely from the fluorometer at distances of up to several meters from the fluorometer in said body of water,

and wherein the excitation system and the detection system are each provided in a respective housing, the respective housings being located adjacent one another and arranged such that there is an overlap, during use, between said generally conical divergent beam emanating from the excitation system housing and said generally conical convergent detection volume of the detection system housing,

and wherein the respective housings have a respective longitudinal axis, said longitudinal axes being substantially parallel with one another, and said generally conical divergent beam and said generally conical convergent detection volume are substantially aligned with said respective longitudinal axis.

43. (Previously presented) A fluorometer as claimed in Claim 42, wherein the respective

housings are adjustably interconnected so that the relative angular disposition between the respective housings may be altered such that the distance of said overlap from said respective housings is altered.

44. (Previously presented) A fluorometer as claimed in claim 1, provided on an underwater vehicle.

45. (Previously presented) A method of determining the level of a fluorescent material in a body of water remotely from a fluorometer, the fluorometer comprising an excitation system including an excitation source for producing excitation light capable of causing fluorescence in fluorescent material; and a detection system for detecting said fluorescence, the method comprising:

generating said excitation light using at least one light emitting diode (LED);

causing said excitation light to project from said excitation system in a generally conical divergent beam;

using at least one collimating lens to form said divergent beam;

modulating said beam with a modulating signal having a modulating frequency;

receiving light at said detection system and converting said received light into a corresponding electrical signal;

using at least one lens to provide a generally conical convergent detection volume for the detection system, said generally conical detection volume to converging in a direction towards said fluorometer;

causing said generally conical detection volume to at least partially overlap with said generally conical divergent beam;

detecting, in said electrical signal, a signal component of substantially the same frequency as said modulation frequency;

determining the value of a spectral component of said electrical signal corresponding to said modulation frequency; and

determining the level of fluorescent material present in said body of water depending on said value of said spectral component.

46. (New) A fluorometer as claimed in Claim 1, wherein the generally conical divergent beam projecting from the fluorometer is non-scanned and diverges in a direction away from the fluorometer.

47. (New) A fluorometer as claimed in Claim 20, wherein the excitation system housing and the detection system housing each has a respective optical window through which said conical divergent beam and said received light, respectively, pass during use.

48. (New) A fluorometer as claimed in Claim 42, wherein the generally conical divergent beam projecting from the fluorometer is non-scanned and diverges in a direction away from the fluorometer, and

wherein the excitation system housing and the detection system housing each has a respective optical window through which said conical divergent beam and said received light, respectively, pass during use.

49. (New) A fluorometer as claimed in Claim 45, wherein the generally conical divergent beam projecting from the fluorometer is non-scanned and diverges in a direction away from the fluorometer.